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Intellectual Property Administration

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EXAMINER

ROCHE, TRENTON J

ART UNIT

PAPER NUMBER

2124

DATE MAILED: 09/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|--------------------------------------|-------------------------------------|--|
| Office Action Summary | Application No. 10/004,015 | Applicant(s) HUNDT ET AL. | |
| | Examiner Trent J Roche | Art Unit 2124 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 October 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 October 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

~~Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).~~

- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This office action is responsive to communications filed 18 October 2001.
2. Claims 1-12 have been examined.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-3, 6, 7 and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,822,787 to Zucker.

Per claim 1:

Zucker discloses:

~~a computer implemented method for optimization of an executable program that calls~~

procedures in a shared library comprising identifying linkage code segments in the executable program, wherein each linkage code segment is associated with a call to a procedure in the shared library (“Calls to Functions in Shared Object Modules... The program further comprises a procedure linkage table (PLT) section, including a procedure linkage table for each object module for redirecting position-independent function calls to absolute locations” in col. 11 line 65 to col. 12 line 2)

- reads procedure address information from a linkage table, and transfers control to an associated one of the procedures (“The procedure linkage table receives calls to these

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functions, gets the absolute addresses from the pointer table and branches to the absolute addresses of the functions” in col. 13 lines 1-4)

- reading the address information from the linkage table (“The procedure linkage table receives calls to these functions, gets the absolute addresses from the pointer table and branches to the absolute addresses of the functions” in col. 13 lines 1-4)
- generating respective substitute code segments for the linkage code segments, each substitute code segment having references to the linkage table replaced by direct loads of the address information without reference to the linkage table (“The dynamic linker creates memory segments for a relocatable object file...The dynamic linker uses the relocation table and symbol table to adjust instructions, data and PLT entries to account for the absolute memory addresses at which they reside at run time” in col. 10 lines 25-35)
- executing the substitute code segments instead of the linkage code segments (“Upon subsequent calls to the entry for the first function...the dynamic linker will not be called. Instead, execution will branch directly to the function...” in col. 15 lines 60-62)

substantially as claimed.

Per claim 2:

The rejection of claim 1 is incorporated, and further, Zucker discloses allocating relocation address space for the executable program, and storing the substitute code segments in the relocation address space as claimed (“the link editor reserves space for them in the process images, and the dynamic linker initializes them and manages them...” in col. 13 lines 27-29)

Per claim 3:

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The rejection of claim 1 is incorporated, and further, Zucker discloses identifying registers that are not used by the calling procedure, and generating in a substitute code segment instructions that store in the registers the address information read from the linkage table (“Once the base address has been obtained and loaded into a user register, the absolute addresses of the symbols in the global offset table can be resolved for memory access...” in col. 10 lines 64-67.)

Per claim 6:

The rejection of claim 1 is incorporated, and further, Zucker discloses the executable program includes a calling procedure that calls a first procedure and a second procedure in a first shared library and calls a third procedure in a second shared library, further comprising: identifying a set of registers that are not used by the calling procedure; generating in a substitute code segment instructions that store in the registers in the set the address information read from the linkage table configuring a substitute code segment associated with the first procedure to load the address information from one of the registers in the set into a branch register prior to transferring control to the first procedure; and eliminating from a substitute code segment associated with the second procedure, an instruction that loads the address information into the one of the registers if the second procedure is called after the first procedure and before the third procedure as claimed (“the register is a link register; said first instruction is a “branch and link” instruction that causes the processor to branch to said second instruction and load an address of a third instruction in said function that directly follows said first instruction into the link register; said second instruction is a ‘branch to link register and link instruction that causes the processor to branch to said third instruction and load said absolute base address into the link register...the computer further

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comprises a user register; said third instruction causes said absolute base address to be copied from the link register into the user register.” in col. 23 lines 19-34)

Per claim 7:

The rejection of claim 1 is incorporated, and further, Zucker discloses the executable program including a call to a first procedure in a first shared library that calls a second procedure in a second shared library, further comprising in the substitute code segment associated with the call by the first procedure to the second procedure, replacing an indirect branch instruction that targets the second procedure with an instruction-pointer relative branch instruction that targets the second procedure (“the number of shared object modules that can be included in the process image is not limited...” in col. 9 lines 8-9. Further, “Once the base address has been obtained and loaded into a user register, the absolute addresses of the symbols in the global offset table can be resolved for memory access...” in col. 10 lines 64-67.)

Per claim 12:

Claim 12 is directed to an apparatus for performing the method of claim 1, and is rejected for the reasons set forth in connection with claim 1.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary

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skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,822,787 to Zucker in view of U.S. Patent 5,956,479 to McInerney et al, hereafter referred to as McInerney.

Per claim 4:

The rejection of claim 1 is incorporated, and further, Zucker discloses generating a substitute linkage code segment (Note the rejection of claim 1). Zucker does not explicitly disclose annotating linkage code segments, and placing breakpoints at locations of the linkage code segments as indicated by the annotations. McInerney discloses in an analogous remote linking system code annotations, and placing breakpoints at locations of linkage code as claimed (Note Figure 3 and Figure 4 and the corresponding sections of the disclosure). It would have been obvious to one of ordinary skill in the art at the time the invention was made to annotate and place breakpoints at locations of linkage code in the system disclosed by Zucker, which would allow the user to perform debugging methods on the code, thereby increasing the quality of the overall code and system.

Per claim 5:

The rejection of claim 4 is incorporated, and further, Zucker discloses registers that are not used by a calling procedure that calls a called procedure in the shared library, and generating in the substitute code segment instructions that store in the registers the address information read from the linkage table (Note the rejection of claim 3). Zucker does not explicitly disclose annotations. McInerney discloses in an analogous remote linking system the use of annotations as claimed (Note Figure 3). It would have been obvious to one of ordinary skill in the art at the time the invention was made to

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use annotations in the system of Zucker, as this would a developer to specify relevant information to the compiler, thereby increasing the performance of the compilation.

7. Claims 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,822,787 to Zucker in view of U.S. Patent 6,026,235 to Shaughnessy.

Per claim 8:

The rejection of claim 1 is incorporated, and further, Zucker discloses searching for linkage code segments in the procedure, generating substitute linkage code segments for those identified in the procedure, and continuing with execution of the procedure (“When a function that cannot be reached by relative branching is first called through the respective entry, the entry branches to the dynamic linker call section...and alters the entry to subsequently branch to the absolute address...” in col. 13 lines 12-17). Zucker does not explicitly disclose placing breakpoints at procedure entry points. Shaughnessy discloses in an analogous remote linking system that the patching of code to ~~place breakpoints at procedure entry points was well-known to one of ordinary skill in the art at the~~

time the invention was made (“the approach is idea for patching function entry points, it is often employed by software debuggers” in col. 3 lines 37-39). It would have been obvious to one of ordinary skill in the art at the time the invention was made to place breakpoints at procedure entry points in the system disclosed by Zucker, which would allow the user to perform debugging methods on the code, thereby increasing the quality of the overall code and system.

Per claim 9:

The rejection of claim 8 is incorporated, and further, note the rejection regarding claim 2.

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Per claim 10:

The rejection of claim 8 is incorporated, and further, note the rejection regarding claim 2.

Per claim 11:

The rejection of claim 8 is incorporated, and further, note the rejection regarding claim 7.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent 5,923,882 to Ho et al discloses a system utilizing dynamically shared programs and libraries, including the ability to identify linkage code segments, read procedure address information from a linkage table, transfer control to an associated procedure, and generating intermediate code for calling the shared program or library.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Trent J Roche whose telephone number is (703)305-4627. The examiner can normally be reached on Monday - Friday, 9:00 am - 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kakali Chaki can be reached on (703)305-9662. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Trent J Roche
Examiner
Art Unit 2124

TJR

Kakali Chaki
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SUPERVISORY PATENT EXAMINER
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